

Chapter Seven

Adapting to Climate Change

It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change.

Charles Darwin



Coyote in a Los Angeles suburb.

Photo credit: Troy Boswell / Los Angeles Animal Services.

When used in the context of climate change, *mitigation* refers to actions that reduce the extent of climate change, and *adaptation* refers to actions that reduce the vulnerability of the built environment to the effects of climate change. Even if humankind was somehow able to immediately stop the production of new greenhouse gases, the high concentration of carbon dioxide and other gases contributing to the greenhouse effect which are already in the atmosphere (from emissions from the burning of fossil fuels for energy beginning in the 19th century) would continue to change the climate.

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Ideally, a local, regional, state or national climate strategy would address both mitigation and adaptation in an integrated manner. To date, much of California's climate policy (as described throughout this Plan) has focused on mitigating the impacts of climate change through actions to reduce greenhouse gas emissions. The primary State effort addressing adaptation has been to provide information about the climate-related risks facing California and their potential consequences and impacts.

One key example of the state's efforts is the *2009 California Climate Adaptation Strategy*, prepared by the California Natural Resources Agency in response to Governor Schwarzenegger's 2008 Executive Order S-13-08. The Executive Summary opens with the following:

Climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The state has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and both snowmelt and rainwater running off sooner in the year.

These climate driven changes affect resources critical to the health and prosperity of California. For example, forest wildland fires are becoming more frequent and intense due to dry seasons that start earlier and end later. The state's water supply, already stressed under current demands and expected population growth, will shrink under even the most conservative climate change scenario. Almost half a million Californians, many without the means to adjust to expected impacts, will be at risk from sea level rise along bay and coastal areas. California's infrastructure is already stressed and will face additional burdens from climate risks. And as the Central Valley becomes more urbanized, more people will be at risk from intense heat waves.

If the state were to take no action to reduce or minimize expected impacts from future climate change, the costs could be severe. A 2008 report by the University of California, Berkeley and the non-profit organization Next 10 estimates that if no such action is taken in California, damages across sectors would result in "tens of billions of dollars per year in direct costs" and "expose *trillions* of dollars of assets to collateral risk." More specifically, the report suggests that of the state's \$4 trillion in real estate assets "\$2.5 trillion is at risk from extreme weather events, sea level rise, and wild-fires" with a projected annual price tag of up to \$3.9 billion over this century depending on climate scenarios. (p. 3)

Clearly, the stakes are high, and the obstacles and level of uncertainty are considerable. Effective policy-making will need to reflect flexibility and commitment in spite of these obstacles. The Public Policy Institute of California (PPIC) found that “When asked to consider some possible effects of global warming in the state, Californians are more likely to be very concerned about more severe wildfires (56%), more severe droughts (48%), and increased air pollution (45%) than about increased flooding (28%).”¹

In another publication, PPIC notes that government agencies, along with public and private utilities, play a critical role in climate adaptation “. . . because they are responsible for providing services, making infrastructure investments, setting the regulatory contexts, and shaping the incentive structures in which individuals and business will make their own adaptation decisions.”² The report also describes six particularly vulnerable areas of concern -- water resources, electricity, coastal resources, air quality, public health, and ecosystem resources – to which could be added other areas such as cultural and historical resources, transportation systems, and the local economy.

The challenge of pursuing an integrated climate strategy is complicated by the fact that, while some mitigation and adaptation strategies are synergistic, others are at cross purposes. In those cases, tradeoffs will need to be considered. The different time horizons of the two strategies – the longer-term perspective of mitigation versus the shorter-term needs of adaptation -- is one factor which may reinforce conflicts. Examples of synergistic actions in this Plan include those which work to reduce greenhouse gas emissions by curbing energy use through improved energy efficiency in buildings. This mitigation strategy also supports the adaptation goal of creating less demand on the electric grid during extreme events such as heat waves, thereby decreasing the likelihood of power blackouts or brownouts. Another example is the mitigation strategy of increasing carbon sequestration by expanding tree planting across the city, which also supports the adaptation goal of counteracting the urban heat island effect through shade and increased natural cooling for buildings.

Figure 7-1 provides additional examples of mitigation and adaptation actions which are complementary or conflicting, and underscores the complexities facing communities, public agencies, the private sector, and individuals seeking to successfully address climate challenges and reduce and manage risk.

¹ Baldassare, M., Bonner, D., Petek, S., and Shrestha, J. *Californians and the Environment*, p. 15. Copyright 2011. Public Policy Institute of California. All rights reserved. San Francisco, CA.

² Louise Bedsworth and Ellen Hanak. *Preparing California for a Changing Climate*, p. 1. Copyright 2008, Public Policy Institute of California. All rights reserved. San Francisco, CA.

Figure 7-1

Complementary and Conflicting Adaptation and Mitigation Actions

Complementary and Conflicting Adaptation and Mitigation Actions			
Favorable Actions		Unfavorable Actions	
Favorable for Adaptation and Mitigation Efforts	Favorable for Mitigation, but Unfavorable for Adaptation Efforts	Favorable for Adaptation, but Unfavorable for Mitigation Efforts	Unfavorable for Adaptation and Mitigation Efforts
<ul style="list-style-type: none"> Energy Demand Management Energy Efficient Buildings Water Conservation Biodiversity-Oriented Forestry "Smart Growth" Development in Cooler Regions 	<ul style="list-style-type: none"> Forestry with Non-Native Species Urban Forestry (shade trees) with High Water Demand Some Biofuels Production 	<ul style="list-style-type: none"> Meeting Peak Energy Demand with Fossil Fuels Wastewater Recycling and Desalination Groundwater Banking Increased Air Conditioner Use Use of Drainage Pumps in Low Lying Areas 	<ul style="list-style-type: none"> Development in Floodplains Traditional "Sprawl" Development Development in Hotter Regions
Source: Bedsworth and Hanak (2008) - Reprinted with Permission by Authors			

The San Francisco Planning and Urban Research Association (SPUR) notes "Climate change adaptation will need to be dealt with at all levels of government. Yet it is at the local and regional levels where vulnerability can best be understood and addressed."³ The report describes the vulnerability assessment -- defined as "an evaluation of a system's risk compared to its adaptive capacity, or ability to cope with climate change" (p. 5) -- as the main tool of adaptation planning. By way of example, a vulnerability assessment addressing sea level rise in Fremont -- which is highlighted in the SPUR report as the Bay Area's "most difficult climate adaptation challenge" - would map anticipated water levels to identify areas, facilities and populations at potential risk. This information would inform the discussions and decision-making about how to most effectively respond to the risks.

The development of adaptation plans by public agencies, including local governments, is in a nascent state. However, a cross-sector, regional approach to adaptation planning which integrates local assessments of vulnerabilities, will likely prove the most efficient way to utilize limited resources to provide the greatest benefit. As SPUR states:

It is no surprise that no local governments in the Bay Area have adopted a comprehensive approach or plan to handle projected sea level increases on either the Bay or the Pacific Ocean. Local government planning efforts are generally underfunded, meanwhile sea level rise is perceived as a new threat that will not cause significant harm or require emergency response for years, if not decades. There is no public consensus around how to plan for sea level rise, or the most appropriate risk, financial and land-use management strategies for local governments to adopt. There is also a hope that

³ San Francisco Planning and Urban Research Association, *Climate change hits home: Adaptation strategies for the San Francisco Bay Area*, May 2011, p. 29.

federal, state or even regional organizations will step up with resources and planning tools that local governments will need to negotiate the problem – and also work to phase out programs and policies that can increase future risk to sea level rise, particularly in existing flood-prone areas. (ibid., p. 25)

As discussed in Chapter One of this Climate Action Plan, Fremont will monitor the adaptation planning efforts anticipated by the Bay Area Climate Compact signatory cities of San Francisco, Oakland and San Jose, as well as the *Adapting to Rising Tides* (ART) collaboration, to inform the city's future work on adaptation planning. In early 2011, Alameda County, from Emeryville to Union City, was selected by the two sponsoring agencies - the San Francisco Bay Conservation and Development Commission (BCDC) and the National Oceanic and Atmospheric Administration Coastal Services Center - as the focus of Bay Area planning for sea level rise and other climate change impacts. The ART project is addressing the issues of how sea level rise and other climate change impacts will affect the future of Bay Area communities, ecosystems, infrastructure, and economy, and what strategies should be pursued on the local and regional level to address the impacts and manage the risks.

The California Energy Commission provided funding and oversight to UC Berkeley's Geospatial Innovation Facility to develop the Cal-Adapt web site. The website is intended to provide data and tools to the general public, researchers and decision makers for better understanding the risks posed by climate change. The website, <http://cal-adapt.org> will continue to be expanded as new information is made available.

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